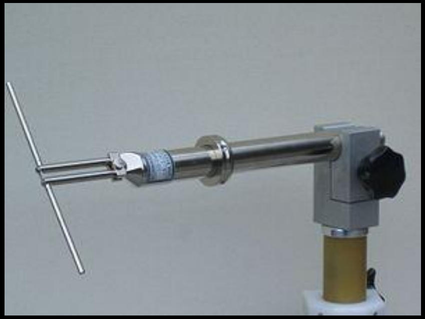
ANTENNAS



ANTENNA

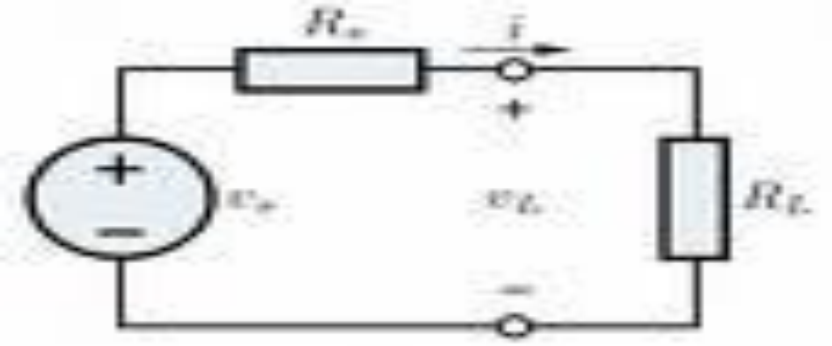
A structure that is generally a metallic object, often a wire or group of wires, used to convert high frequency signals into electromagnetic waves and vice versa.

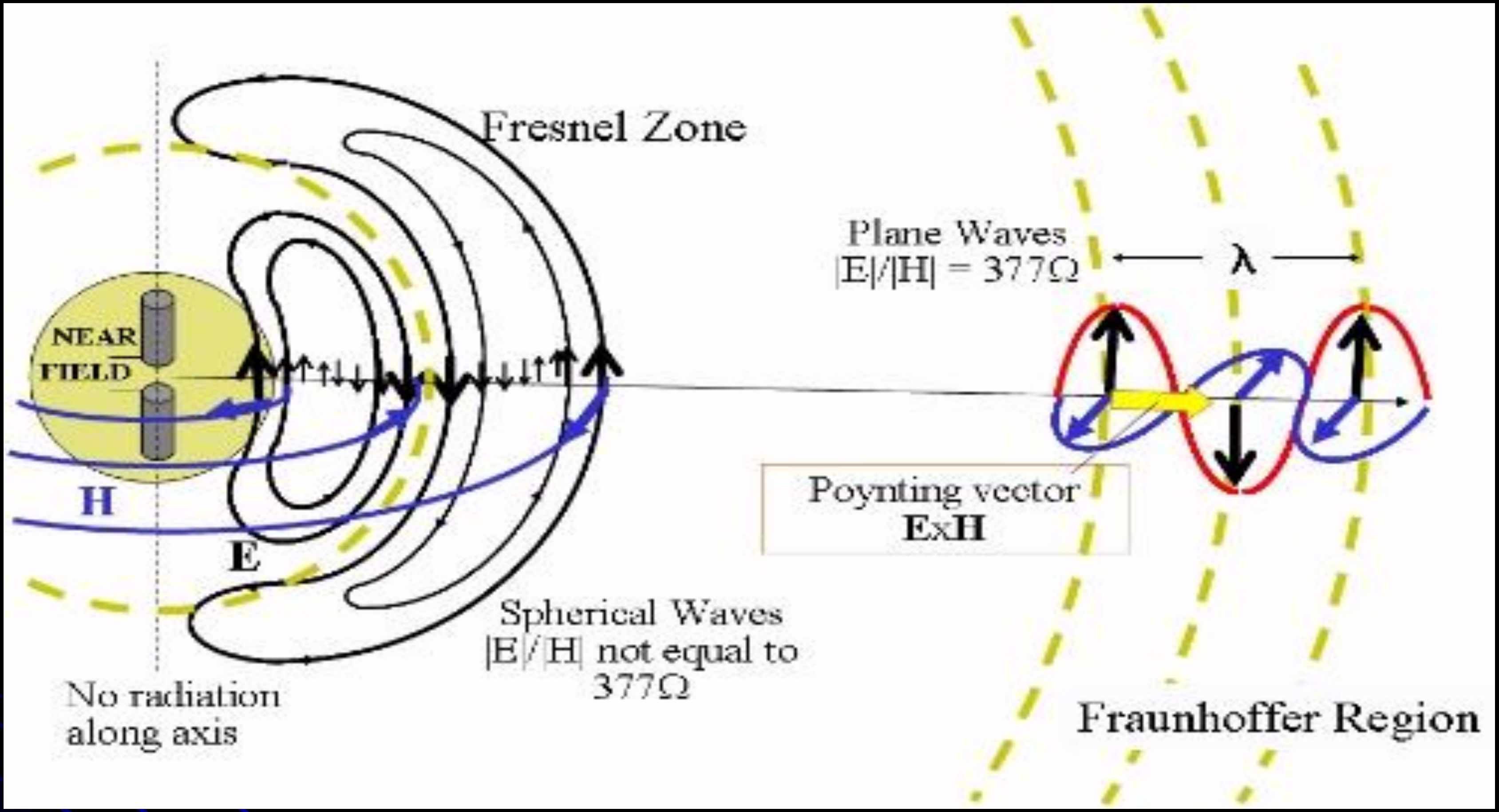
ANTENNA

A device whose function is to radiate electromagnetic energy and/or intercept electromagnetic radiation

paraboloid reflector for 12 GHz

Basic Consideration: Maximum Power Transfer





FIELDS OF AN ANTENNA

INDUCTION FIELD

Considered to extend out from the antenna to a distance of $\pi D^2/8\lambda$

Near Field or Fresnel Region

RADIATION FIELD

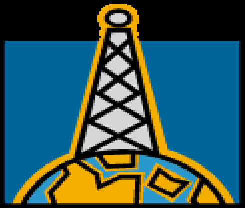
Considered to extend out from a distance of $2D^2/\lambda$

Far Field or Fraunhoffer Region

TRANSITION ZONE

Zone between the two(2) regions

FIELDS OF AN ANTENNA



BASIC FORMULAS

$$T = 1/f$$

Where: T – time

F - frequency

$$\lambda = c/f$$

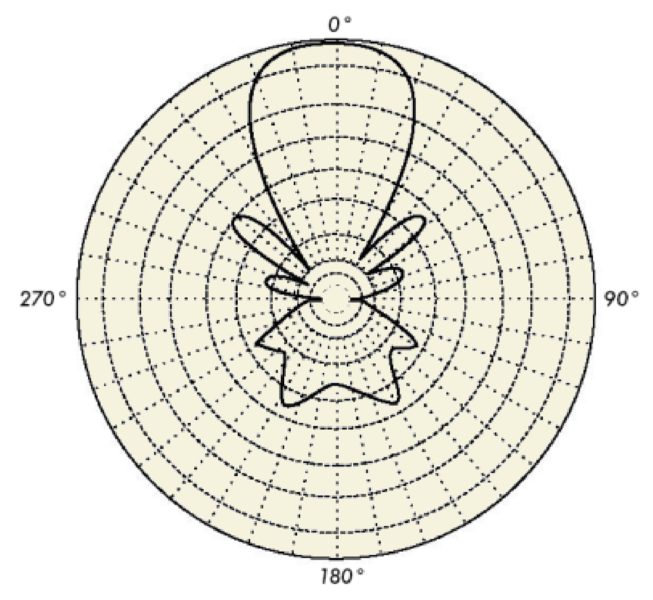
Where: λ – wavelength

F – frequency

C – velocity in free space

RADIATION PATTERN

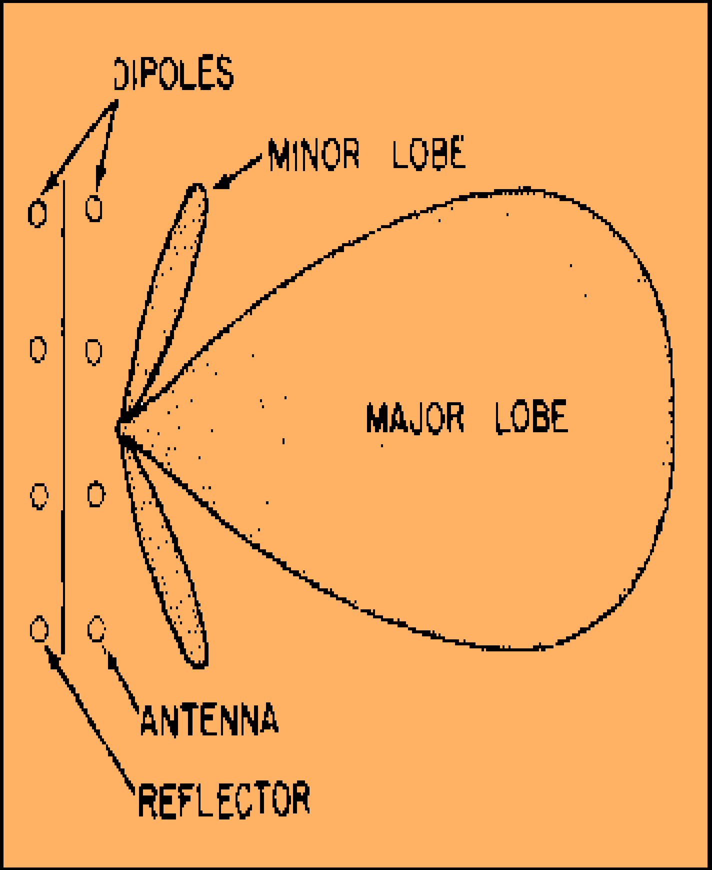
A line drawn to join points in space which have equal field intensity due to the source.



Major Lobe – the direction of maximum radiation

Minor Lobe – the direction of minimum radiation

Null – the direction with radiation intensity equal to zero.



RADIATION PATTERN

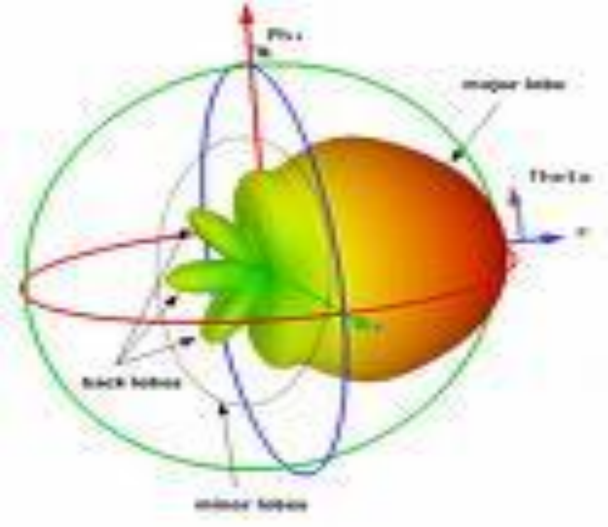
FACTORS WHICH DETERMINE THE RADIATION PATTERN OF AN ANTENNA

a. Antenna height

b. Power losses

c. Terminations at its end

d. Thickness of the antenna wire



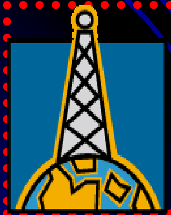
RADIATION PATTERN

PRINCIPLE OF RECIPROCITY

The characteristics of antennas, such as impedance and radiation pattern are identical, regardless of use for reception or transmission.

ISOTROPIC ANTENNA

An antenna that radiates uniformly in all directions in space



DIRECTIVE GAIN

The ratio of the power density in a particular direction of one antenna to the power density that would be radiated by an isotropic antenna.

HERTZIAN DIPOLE: 1.5 : 1 (1.76 dB)

HALF WAVE DIPOLE: 1.64 : 1 (2.15 dB)

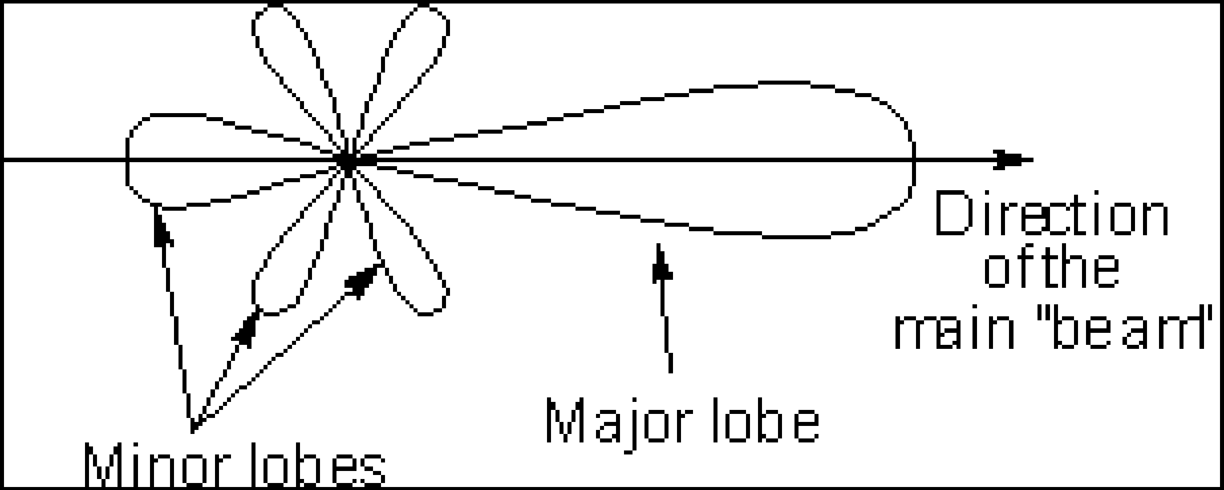
NOTES

The longer the antenna, the higher the directive gain

Non resonant antennas have higher directive gain than resonant antennas

The directive gain of all practical antennas is greater than unity

DIRECTIVITY, D



Maximum directive gain

The gain in the direction of one of the major lobes in the antenna’s radiation pattern.

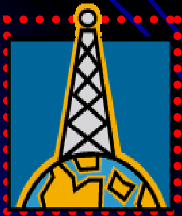
POWER GAIN

Overall gain considering losses and efficiency

Ap = %D

Where: % - antenna efficiency

D - directivity



ANTENNA RESISTANCE

The ratio of the applied voltage to the flowing current

1. RADIATION RESISTANCE, Rr

AC resistance

The ratio of the power radiated by the antenna to the square

2. LOSS RESISTANCE, Rd

Antenna and ground resistance

Discharge or corona effects

Losses in imperfect dielectric very near the antenna

Eddy current loss

GENERAL CHARACTERISTICS OF ANTENNAS

ANTENNA EFFICIENCY

The ratio of the power radiated by the antenna to the power delivered at the feedpoint

The ratio of radiation resistance to the total system resistance

$$\% = Rr / Rr + Rd$$